CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	**Date**	**Description and reason of revision**
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

ANAEROBIC DIGESTION SWINE WASTEWATER TREATMENT WITH ON-SITE POWER PROJECT (ADSW RP2001)
-Version 4
-Completed 7 November 2008

A.2. Description of the small-scale project activity:

The Anaerobic Digestion Swine Wastewater Treatment With On-Site Power Project (ADSW RP2001) (hereafter, the "Project") that is being developed by Hacienda Bio-Energy Corporation (hereafter referred to as the "Project Developer" or "HBC") is an anaerobic digestion swine wastewater treatment project coupled with an on-site power generator at ACME Farms, Inc., Barangay Buhangin, Dalig, Teresa, Rizal (hereafter referred to as the "ACME Farm" or the "Farm"). Philippine Bio-Sciences Co., Inc. (hereafter referred to as "PhilBIO") has been contracted for the design, engineering, operations and management of the Project.

The farm, located at Barangay Buhangin, Dalig, Teresa, Rizal, is owned and managed by Acme farms employs normal scraping and hose-down cleaning of waste, mixing the manure with urine and wastewater leading to a series of open lagoons. Such lagoon-based treatment is a low to zero cost standard practice in the South East Asian region. This waste material is left to decay in the facility's open lagoon system, producing significant amounts of biogas methane that is emitted directly to the atmosphere. This biogas emission contributes to significant air (odour) and water pollution in the areas close to the farms.

The Project introduces a method of utilizing biological treatment to enhance the farm's wastewater treatment. The Project has four principle objectives:

(a) Manage the farms wastewater, and reduce the organic loading of the wastewater (reducing the risks of wastewater with a high organic loading permeating ground water reservoirs or entering nearby water courses)
(b) Reduce odour that is a significant issue for local people;
(c) Project power from captured biogas to promote energy self sufficiency on the farm; and
(d) Reduce harmful emission of greenhouse gases.

The 'Covered In-Ground Anaerobic Reactor' (or the 'CIGAR®[1]'), effectively breaks down organic contaminants through a multi-step biological treatment of the wastewater in the absence of oxygen. High-density polyethylene (HDPE) liner and cover are used to provide for a 'air tight' and to prevent leachate from percolating through the ground and polluting local ground water aquifer resources. The results: around 95% destruction of harmful biochemical oxygen demand (BOD), and 80% reduction of chemical oxygen demand (COD). Suspended solids are to be reduced and colour is to be improved in the CIGAR® system. The digester is designed to maintain a 30 days retention time (number of days in the CIGAR®), and this continued exposure to temperature in the order of 35°C to effectively reduce pathogenic material.

[1] CIGAR is a duly registered trademark owned by PhilBIO with the Intellectual Property Office (IPO) of the Philippine Bureau of Trademarks.

The effluent is then sent to a final treatment lagoon where normal facultative aerobic process predominates. If there is any case a need of effluent discharge to the local watercourse, it will do so well within the Department of Environment and Natural Resources (the 'DENR') standards. The project dramatically reduces the risk of effluent with a high organic loading ever actually reaching local water courses.

In this system, biogas is recovered through its CIGAR® design. Methane, a potent greenhouse gas and potential energy source, is on average 65% of the biogas by volume emitted from the current lagoon based treatment to atmosphere and captured utilising CIGAR®. In the farm's CIGAR®, the wastewater is expected to produce an average of 612 m^3 of biogas per day from the system all year around.

The biogas produced in the farm's anaerobic digesters will be used to generate electricity for use on-site. A biogas-fuelled 100 KW generator set, producing 767MWh of electricity annually (conservative estimate), will be installed. The generator sets will directly to the farm for meeting its power needs.

The capacity of the generator set is designed to match the actual peak demand of the farm. This peak demand may alter (increasing and decreasing) year on year as a result of a variety of factors such as demand for pork and disease, etc (it is not necessarily a static demand). The design of the project to match actual peak demand is deliberate as the host farm is the only potential buyer of power generated at present, there is an inability to export surplus energy to the grid with possible surplus biogas having to be flared. This is due to the regulatory restrictions on small private power producers exporting to the grid at the time of project development in the Philippines[2].

Due to the changes of the power demand in the farm throughout the course of the day, the maximum power generation capacity of the project will not be reached. It is the characteristic of the generator set that its output is automatically adjustable to the power demand instantaneously. Thus the electrical output of the project activity will never be greater than the actual captive demand of the host farm.

The CIGAR® has been designed with some gas storage capacity. Any surplus biogas, where produced, will be kept inside the CIGAR®. In any case the storage limit might be reached, a methane destruction system will be installed, for example an open flare or additional generator sets for the use of the farm or to export to the grid when regulatory barriers are removed to allow the export of surplus electrical energy to the local distribution grid.

The Project will make a significant contribution to helping the Host Country meet its sustainable development goals outlined in the Philippine Agenda 21 with the following benefits observed:

Macro Level Benefits

- Clean technology both in wastewater management and in renewable energy will be demonstrated and may be replicated throughout the country's livestock sector as well as in the Asian region;
- National energy self-sufficiency is increased with the use of cheap, renewable and indigenous energy resources, which correspondingly decreases dependence on imported fossil fuel and a reduction in negative impacts of fuel imports on the nations balance of payments;
- Global environmental protection is supported by the capture of fugitive GHGs; specifically methane, and the reduction in energy related emissions;

[2] Also refer to section B.5 for more information on the export restriction.

- A New Financial Mechanism for financing in the renewable energy and waste management sectors via the Clean Development Mechanism (CDM) is positively demonstrated and shown to present an alternative development path through the improvement in the financial viability of marginal projects; and
- Incremental reduction on the need for new build power plants at a national level.

Micro Level Benefits

- Control of leachate that would otherwise pollute groundwater resources;
- Reduction in wastewater emissions to local water resources;
- A Healthier and Safer Work Place is developed with improvements in local air quality, and control of highly combustible methane emissions;
- Considerable reduction in odour from the existing treatment facility that currently affects local communities;
- Increased energy self sufficiency of the project host;
- Improvement in the viability of rural enterprises, enterprises that support local employment in the agricultural sector; and
- Generation of locally produced energy to provide a more reliable energy source than the current grid system.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants(*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant
The Philippines (host)	Hacienda Bio-Energy Corporation	No
The United Kingdom	Trading Emissions PLC	No

Trading Emissions PLC (TEP) is the official contact for the CDM project activity and Focal Point for all communication with the CDM EB. Further contact information of project participants is provided in Annex 1.

A.4. Technical description of the small-scale project activity:

Figure 1 Lagoon, The Local Common Practice

HBC and PhilBIO propose an alternative manure waste management system to recover methane gas emissions as an alternative to the current open lagoon systems. Wastewater treated in these lagoons is often at an ambient temperature of around 35ºC, and under anaerobic conditions. The result of this is that biogas methane is emitted continuously from lagoons as can be seen in this typical farm lagoon system image.

Through its engineering product, the CIGAR®, the biogas recovered from each farm will be used to provide fuel for each farm's on site electric power plant.

The CIGAR® breaks down organic contaminants through a three-step biological process where wastewater is treated in the absence of oxygen. The anaerobic bacteria present inside the CIGAR® digests the organic content, specifically the total solids of the wastewater. This effectively minimizes the amount of sludge left inside the CIGAR. With proven experience, desludging is hardly required for the system. If the need arises, the sludge will be bagged, weighed, and properly disposed of through composting.

The effluent is retained in the reactor where complex microbial consortia breakdown the waste to methane and carbon dioxide which is used as biogas for electricity generation on site (*Figure 2 the CIGAR System*). The biogas stored in the CIGAR will be used to start-up the biogas engine, eliminating the need to use grid-fed electricity or diesel fuel, during start-ups.

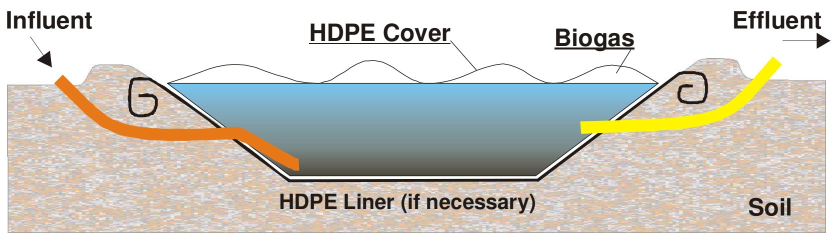

Figure 2 The CIGAR® System

An HDPE liner and cover are used to provide an 'airtight' system to prevent leachate from escaping to the underground aquifer and to prevent methane from escaping to the atmosphere. The CIGAR® system is 'covered' 100% of the time with 1.0mm HDPE liners. This process results in at least 95% destruction of harmful BOD, and 80% reduction of COD. Suspended solids are reduced and colour is improved in the CIGAR®. The internal environment of 35^{o}C also reduces any pathogenic material within the wastewater. The reduced organic loading effluent is then sent to a final treatment lagoon where normal facultative aerobic process predominates to reduce further any remaining organic material. Methane gas makes up at least 65% of the biogas by volume. The biogas produced from the farm will be used to generate electricity through the electricity generation unit located within the farm's boundary.

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

Philippines

A.4.1.2. Region/State/Province etc.:

Region IV-A, CALABARZON, Rizal

A.4.1.3. City/Town/Community etc:

Teresa municipality, Dalig, Barangay Buhangin

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity:

The Project is located at ACME farm at Barangay Buhangin, Dalig at the municipality of Teresa, Rizal. The GPS coordinates are N14°36.453', E121°14.080'. Please refer to *A.2. Description of the small-scale project activity* and *Figure 3 Location Maps* for each farm's specific location.

Rizal is a province of the Philippines located in the CALABARZON Region (IV-A) in Luzon, just 20Km east of Manila. Rizal's capital is Antipolo City, although the provincial capitol is located in Pasig city in metro manila, which was the previous capital.

The province, being surrounded by metro manila (west), Bulacan (north), Quezon province (North), and Laguna (south); is also known to have the 2nd highest population density in the country. It also lies at the northern shores of Laguna Lake (the country's largest lake). The primary source of economy in Rizal province is huge piggery estates owned by manila- based families. In the northern town, farming is the main industry, while fishing predominates in the southern towns.

Teresa is a 4th class urban municipality in the province of Rizal, Philippines. It has a population of 29,475 people in 6,374 households. The municipality is situated in the slopes of the Sierra Madre Mountains and is landlocked on four corners by Antipolo city on the north, Angono on the west, Baras on the east, and Morong, on the south. Formerly, the predominant source of livelihood in Teresa is agriculture. But with the opening of large cement factory, marble quarry, and chemical factories, members of the community have slowly shifted to industry. Also, a surge in population occurred during the 90s due to the real estate boom.

Figure 3 Location Maps[3]

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

The categories for the project activities according to the UNFCCC's published Appendix B of the simplified modalities and procedures for small-scale CDM project activities are:

- Type I.D (reference AMS-I.D v.12) – "*Grid connected renewable electricity generation*" – for the electricity generation component; and,

- Type III.D (reference AMS-III.D v.13) – *"Methane recovery in agricultural and agro industrial activities"* – for the methane recovery component.

The project activities conform to project category III.D since the Project will reduce anthropogenic emissions by sources, directly emit less than 15kt of carbon dioxide equivalent annually, and result in emission reductions lower than or equal to 60ktCO_2e annually. The project activities conform to project category I.D since the renewable generating units will displace electricity from an electricity distribution system and supply an individual user with a small amount of electricity and the capacity will not exceed 15 MW. A detailed discussion of the technology of the project activities can be found in *Section A.4*.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Years	**Annual estimation of emission reductions in tonnes of CO_2e**
Year 2008 (December)	803
Year 2009	2,409
Year 2010	2,409
Year 2011	2,409
Year 2012	2,409
Year 2013	2,409
Year 2014	2,409
Year 2015 (January to November)	1,606
Total estimated reductions (tonnes of CO_2e)	16,861
Total number of crediting years	7 (renewable up to 21 years)
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	2,409

A.4.4. Public funding of the small-scale project activity:

The host farm for the project will provide land and the wastewater while the project developer will fund the Project entirely. The Project has not received and will not seek public funding.

[3] Source: Wikepedia, The Free Encyclopedia, www.en.wikepedia.org

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large-scale project activity:

Based on the information provided in Appendix C of the simplified modalities and procedures for small-scale CDM project activities, this project activity is not a debundled component of a larger project activity since the project participants have not registered nor operated another project in the region surrounding the project boundaries with this specific Host.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

Project activity type I.D (reference AMS-I.D/version 12) – *Grid connected renewable electricity generation*; and,

Project activity type III.D (reference AMS-III.D/version 13) – *Methane recovery in agricultural and agro industrial activities.*

B.2 Justification of the choice of the project category:

The Project conforms to project category III.D since the Project will reduce anthropogenic emissions by sources, directly emit less than 15kt of carbon dioxide equivalent annually, and result in emission reductions lower than or equal to 60ktCO_2e annually. The Project conforms to project category I.D. since the renewable generating unit will displace electricity from an electricity distribution system and supply an individual user with a small amount of electricity and the capacity will not exceed 15 MW. A detailed discussion of the technology of the project activity can be found in *Section A.4*.

These selections are appropriate because the alternative to the project activities would be to continue with the business-as-usual scenario. This scenario would continue to manage wastewater through the existing aerobic pond system, and would continue to use electricity from the electricity distribution system in the area.

B.3. Description of the project boundary:

The project boundary for each farm is defined as the notional margin around each project within which the project's impact (in terms of carbon emission reductions) will be assessed. As referred to in Appendix B of the simplified modalities and procedures for small-scale CDM project activities:

- The project boundary for type I.D (AMS-I.D) is the physical, geographical site of the renewable generation source.

- The project boundary for type III.D (AMS-III.D) projects is the physical, geographical site of the methane recovery facility.

For the purposes of this analysis, different boundaries were applied in relation to the elements contributing to project and baseline emissions:

- Electricity and Fuel Oil Displacement/Emissions: The boundaries are assumed to be the physical, geographical site of the generating unit.
- Wastewater Methane Emissions/Mitigation: The boundaries are assumed to be physical, geographical site of the methane recovery facility at each farm's facility.

B.4.	**Description of baseline and its development:**

As specified in Appendix B:

- The appropriate baseline for project category Type I.D (AMS-I.D) is found in paragraphs 9.
- The appropriate baseline for project category Type III.D (AMS-IIID) is found in paragraphs 7 and 8.
- Date of completing the final draft of this baseline section *(DD/MM/YYYY)*: 01/06/07

For AMS-I.D:
Baseline electricity generation emissions are given by:

$$E_{baseline} = EP_{BIO} \text{ x } CEF_{grid}$$

Where:
$E_{baseline}$: Baseline electricity generation emissions (tCO_2e/year)
EP_{BIO}: Electricity produced by the biogas generator unit for grid electricity replacement (MWh)
CEF_{grid}: Emission coefficient for electricity grid (kg CO_2e/kWh). The calculation of CEF is provided in a separate spreadsheet.

For AMS-III.D:
Baseline fugitive GHG emissions are:

$$FE_{baseline} = FM_{baseline} \text{ x } GWP$$

Where:
$FE_{baseline}$: Baseline fugitive GHG emissions (tCO_2e/year)
$FM_{baseline}$: Baseline fugitive methane emissions (t/year)
GWP: Global warming potential for methane (tCO_2e/t)

Baseline fugitive methane emissions are:

$$FM_{baseline} = EF_i \text{ x } Pop$$

Where:

$FM_{baseline}$: Baseline fugitive methane emissions (tCO_2e/year)
EF_i: Annual emission factor of the animal type i (i.e. swine for this document) (kg)
Pop: Swine population

Annual emission factor for swine is:

$$EF_i = VS_i \text{ x } 365 \text{ days/year x } B_{oi} \text{ x } 0.67 \text{ kg/m}^3 \text{ x } \sum MCF \text{ x } MS\%$$

Where:
EF_i: Annual emission factor for swine (kg)
VS_i: Daily volatile solid excreted for swine (kg)
B_{oi}: Maximum methane producing capacity (m^3/kg of VS) for manure produced by swine
MCF: Methane conversion factor for the swine manure management system
MS%: Fraction of swine manure handled using manure system

$$VS = [GE \text{ x } (1-DE\%/100) + (UE \text{ x } GE)] \text{ x } (1-ASH\%/18.45)$$

Where:
VS: Volatile solid excretion per day on a dry weight basis (kg)
GE: Estimated daily average feed intake (MJ/day)
UE x GE: Urinal energy expressed as fraction of GE (MJ/day)
DE%: Digestibility of the feed (%)
ASH%: Ash content of the manure (%)

Therefore, total baseline emissions ($TB_{emissions}$) are:

$$TB_{emissions} = FE_{baseline} + E_{baseline}$$

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

Please refer to Annex 5 for the project timeline.

Market Situation & National Policies

The Philippines has approximately 5 million farms, covering approximately 9.7 million hectares and over 12.14 million pigs, producing a total volume of 1.78 million metric tonnes of pork per annum. The bulk of the pig population comes from smallholder farm, which accounts for about 85% of the total hog inventory. According to the Philippine Bureau of Agricultural Statistics, the livestock sub-sectors grew by about 2.37 percent in 2005 from 2004's negative performance. Hog production represents about 80 percent of the total Philippine livestock industry. Among the regions, Central Luzon accounted for the biggest contribution in swine production. In 2005, the swine sector grew by 3.6 percent. Due to continued strong domestic consumption of pork, hog production will is likely to continue to grow at a rate of 3 to 4 percent in 2006 and beyond despite increased feed cost in the world market. The early part of 2006 showed a 7.5% increase from 2005. Filipinos are large consumers of pork meat and are known to generally prefer pork to chicken or beef[4], and significant quantities can be exported to the Chinese market, where demand is extremely high.

The industry faces a number of obstacles including the spread of economically devastating diseases as experienced in 2004 and 2005, high marketing and transaction costs, erratic supply of imported feed ingredients, supplements and biologics, and the limited availability of genetically superior breeding stock.[5]

The main regulatory agencies that monitor the industry are the Bureau of Animal Industry (BAI) and the National Meat Inspection Commission (NMIC) under the Philippine Department of Agriculture (DA). Environmental regulations are monitored and enforced by the Department of Environment and Natural Resources (DENR). The primary environmental laws applicable to the project are the Clean Water Act (2003) and the Clean Air Act (1999) and the Ecological Solid Waste Management Act (2000).
With the continued rise of the Philippine hog industry, HBC and PhilBIO's core business is to provide wastewater treatment facilities to the numerous hog farms, with a provision for biogas capture for on-site power generation, with a principal view to generating CERs.

PhilBIO developed its very first Philippines pig waste water project in Rocky Farm in 1999, as the project initiator/developer and primary contractor. This particular project has been used as one of the case studies in the CDM capacity building in the Philippines.[6] The project was developed as a demonstration project to show case this alternative waste water and bio-energy resource approach in the Philippines. In the following 5 years PhilBIO developed over 20 turnkey projects with the assistance of CDM financing. All the projects have gone into the CDM registration process, among which 14 projects have been successfully registered as of April 2008.[7] The services offered by the PhilBIO clearly matched the criteria for CDM.

The uptake of such CDM projects on a turnkey basis however has been slow, even with the added incentive of CDM finance, as few farmers (generally relatively small family run enterprises) are willing to take risk with their own capital. The time taken to develop each project having a considerable lead time as PhiBio educated the prospective farm owner as to the risks and benefits of a turnkey approach, as can be demonstrated by the number of projects developed since the first demonstration project at Rocky Farms.

As a result Trading Emission PLC (a listed UK carbon investor) worked with PhilBio to develop a programme to accelerate the development of these small scale projects across the Philippines, and South East Asia. In doing so, HBC was established to develop a programme of projects in the Philippines with CDM as the motivating major driving force. All of the HBC projects are packaged as CDM projects. HBC's initial investment has financed the development of 25 waste water CDM projects in 2007, with further investments committed. This first tranche of projects is in the order of the total number of projects

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[4] Moog, F. A., "Promotion and utilization of polyethylene biodigester in small hold farming systems in the Philippines", Research Division, Bureau of Animal Industry, Manila, Philippines, 1997

[5] Abuel-Ang, Pia, "Philippines Livestock and Products Annual 2004", USDA Foreign Agricultural Service, September 2004

[6] A Dalusung contracted by UNDP and the Department of Environment and Natural Resources, 1999, Capacity Building in Clean Development Mechanism Project Activities: Philippines.

[7] Gold Farm (Ref 0612), Joliza Farm (0607), Uni-Rich Farm (Ref 0609), Gaya Lim Farm (Ref 0611), Paramount Farm (Ref 0605), D&C Farm (Ref 1206), Bondoc Farm (Ref 1205), Superior Farm (Ref 1208), Goldi-Lion Farm (Ref 1207), and Sunjin and Chonas bundled project (Ref 1325)

developed in the preceding 6 years. Project financing documents prepared by the TEP during the financing of this project will be submitted on a confidential basis to the DOE for validation review and in support of CDM registration.

Barrier approach

Evidence as to why the proposed projects are additional is offered under the following categories of barriers: (a) investment barrier, (b) technological barrier and (c) common practice.

a) Access-to-finance Barrier

Small swine farms, have a difficult time securing both internal (own resources) and external (external investments or debt) financing for the implementation of biogas wastewater management projects. The following factors contribute to the investment barrier that these kinds of project face and are perceived by the farm owners themselves and external lending institutions:

- Perceived Risk – Most local banks are not interested in these projects primarily because of lack of knowledge and experience with the technology.

- Bias Against Renewable Energy Projects – Renewable energy projects do not have access to government guarantees like conventional energy projects do, receiving low priority in financing programmes due to the absence of an integrated programme for the development of RE sources. There is also an unfair financing treatment accorded to renewable energy technologies. Most of the attractive financing packages such as extended repayment period apply only to conventional energy projects. Shorter repayment periods for renewable energy projects effectively increase the front-end costs for potential renewable energy project investors. Few renewable energy projects have reached financial closure because of lack of participation of local lending institutions.[8] The main exceptions include some large-scale hydro and geothermal projects,

- Current Practice – The current pond-based treatment method is considered standard operating practice in the Philippines and in the region for wastewater treatment. Moreover, for the project owners, the current pond system (business-as-usual scenario) is extremely financially attractive, given that it works to required specification and requires virtually no management input or investment capital to achieve the key parameters. All required lands are appropriated and the current system has sufficient capacity to handle additional waste.

- Lowest Cost – The current system represents the lowest cost option, with the only cost being the opportunity cost of alternative land use.

- General Culture – The project requires investment capital into a part of the business that is not seen as core to the farmers. Culturally, the often family-owned farm holdings will see investment prioritised into areas that directly benefit the farm and its expansion of inventory. The farms owners perceive a significant link to technological risks from what to many is an unknown technology which

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[8] J.C. Elauria, M.L.Y. Castro and M.M. Elauria, "Biomass Energy Technologies in the Philippines: A Barrier and Policy Analysis", Energy for Sustainable Development, Volume VI, No. 3, September 2002, pp.45-46

further drives a reluctance for investment utilising their own resources. These risks are expanded upon below.

PhilBIO and subsequently HBC, as the technology provider and developer, have sought financing from local lending institutions. Due principally to the factors listed above, the process of securing bank lending has been unsuccessful. A rejection letter from a local bank is quoted that "… our Unit is not yet in a position to finance small scale RE project, and in particular biogas projects that PhilBIO is currently developing in the countryside on BOT arrangement and on unsecured basis. Such projects, on a stand alone are often seen as potentially risky." As a result, the project is entirely financed by TEP as a result of its core interest in the CERs.

HBC believes CDM eligibility is clearly demonstrated under such a financing environment, and also as a result of its investment in HBC to accelerate this programme of project development specifically as a result of the CDM.

Furthermore, even there is a power generation element of the project, the investor cannot enjoy much commercial benefit from its production. In the Philippines, small private power producers are restricted from export to the grid due to the lack of establishment of open access under the Electric Power Industry Reform Act (EPIRA). The EPIRA Law was enacted in 2001 with the aim to provide open access to fair and free competition. However, 7 years on, the implementation has never actually taken place. Given rigorous conditions for any enactment, there is no expectation that distribution liberalization will occur in the immediate future.[9] As a result, the installation of 100 kW is designed to match with the demand of the farm. Even there is potential to utilise surplus biogas to generate additional electricity, the sales outside of the farm cannot be realised at this time.

The project investor feels electricity sales alone do not provide sufficient incentive to attract investment in power production in this sector. The inclusion of CER revenues has therefore become an integral aspect of the Project Developer's implementation and financing strategy. The lack of appetite of the project host to undertake this project and hence the project's additionality, is further demonstrated through the need to attract third party, international, finance through foreign investment in this project, whose objective is to seek access to CERs.

b) Technology Barrier

The standard and well characterized technology for piggery wastewater management in the Philippines is through a series of lagoons. Biological treatment of wastewater to produce biogas is a new and relatively unknown technology in the Philippines. The lack of available knowledge and confidence in the technology, especially among small, privately owned swine farms, makes this type of development difficult to establish. As a result, most swine farm owners view this technology as risky and prefer to maintain their farms in the traditional fashion. This risk is reflected in the fact that there are not many projects of this type in the Philippines. Moreover, many farmers are concerned that a bio-digester project is too complex to operate and maintain. The anaerobic digestion and biogas system that will be utilized in the Project is quite different than previous experience in the Philippines in relation to wastewater

[9] http://www.congress.gov.ph/download/cpbd/Occasional_Paper_05_EPIRA.pdf

treatment. The project activities represent a significantly more technologically advanced alternative to the business-as-usual scenario, and one that carries higher perceived risks.

Anaerobic digestion systems are perceived as relatively high risk, being based upon the function of a biological system that is neither 100% characterized, nor performance-guaranteed. The biological system is at constant risk of chemical shocks that can wipe out the anaerobes and biological activity (and subsequently, the waste management and energy production regimes, which are both keys to commercial operations). The Piggeries industry is prone to disease due to the close confinement of animal populations, and the biological and pharmaceutical agents used to as preventative disease measures, and in disease treatments, are all substances that will shock a digester and the bacterial cultures required to generate biogas within them, often killing the population during the period such materials are being used. Anaerobic digestion systems require constant and on-going precise management of a variety of elements - water flows, pH levels, etc, and the skills to manage such systems are not readily available.). Overall, the project scenario involves higher perceived risks due to the performance uncertainty and a low market share of the new technology.

c) Common Practice

The CIGAR® technology that will be utilized in the project activities is not a common practice in the Philippines and represents as discussed earlier a higher risk alternative to the business-as-usual scenario. At present, lagoon-based treatment is the standard practice in the Philippines and in the regions for swine farms. There is little experience in utilizing aerobic or anaerobic technologies in the Philippine context, and therefore, these are not considered a high-risk management priority. The highest priority for most in the sector is the management of their waste discharges to simply maintain compliance with local regulations. From the operator’s perspective, the lagoon system is a cheap and sufficient way to clean the wastewater.

Summary

The current and expected practice in the host nation, which relies almost exclusively on lagoon-based wastewater treatment facilities for piggeries, as well as the combination of lack of access to financing and perceived risks of the selected technology, clearly demonstrate that the Project is additional and therefore not the baseline scenario. The prohibitive barriers that exist in the Philippines are confirmed by the observed trend in current piggery wastewater management practices.

The barrier analysis above clearly demonstrates that the most plausible baseline scenario is the prevailing practice of lagoon-based systems. The most significant barriers facing the Project are technology familiarity, perceived risk of the technology and the relative lack of investment interest among the key business constituency.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Emission reductions

AMS-I.D:

The electricity generated by the biogas times the CO_2 emission coefficient for the displaced electricity from the grid and of the displaced fossil fuel.

AMS-III.D:
The lower of the two values of (1) actual monitored amount of methane captured and destroyed by the project activity (2) the methane emissions calculated ex ante using the amount of waste or raw material that would decay anaerobically in the absence of the project activity, with the most recent IPCC tier 2 approach.

Project direct emissions

AMS-I.D:
As the Project is utilising biogas with biogenic origins to produce renewable energy, and the design of the system does not include many electrical appliance except for one blower (consuming 3.2 MWh per annum supplied by the system itself). The anthropogenic emissions from this component are considered to be zero.

AMS-III.D:
Project emissions consist of CO2 emissions from use of fossil fuels or electricity for the operation of the facility. As stated in the paragraph above, the systems' design only utilizes one blower, on which the anthropogenic emissions are considered negligible.

As a conservative manner, a number of potential sources are taken into consideration for project emissions, including:

- Physical leakage from the system

The methane recovery facility, the Project, is designed and constructed to collect all the biogas from the digester. First of all, the digester is designed to operate with negative pressure, so that biogas is efficiently sent to the generator. Secondly, the perimeter of the digester employs an 'anchor-trench' lining design, where the liner of the digester exceeds the perimeter by approximately one meter. The gas-impermeable cover of the digester also extends beyond the perimeter of the digester in order to meet the liner. The liner and cover are then sealed at the perimeter of the digester and the overlapped portion (approximately one meter) is then buried and compacted with soil to further anchor the liner and cover. It is very unlikely biogas generated in the digestion process will not be captured by the CIGAR.

Physical leakage from the pipeline is considered to be zero, as the pipeline from collection point to the combustion points is short (less than 1km, and for on site delivery only).

- Methane captured and not flared

It is unlikely that there will be any leakage from the flares, as the flares will only be in use when there is more biogas than can be combusted in the generator. Nonetheless, ex post determination will be defined after the measurement of the flare efficiency is attempted.

It is unlikely that there will be any un-combusted methane from the generator, given the generator has been designed for high performance. Combustion efficiency test will be conducted on the generator each year.

- CO2 emission from combustion of non-biogenic methane

Not applicable. No other fuel than biogas will be used.

- If the sludge is treated and/or disposed anaerobically, the resulting methane emissions shall be considered as project emissions.

Not applicable to ex-ante estimate. No sludge is anticipated to be leaving the system during the crediting period based on the developer's experience. However, the aerobic treatment and/or proper soil application of the sludge leaving the digester in the project activity shall also be ensured and monitored.

Leakage

AMS-I.D, paragraph 12, states that no leakage calculation is required since the equipment is not being transferred to or from another activity.

AMS-III.D, paragraph 9, states that no leakage calculation is required.

Baseline

The total baseline emissions ($TB_{emissions}$) are:

$$TB_{emissions} = FE_{baseline} + E_{baseline}$$

Therefore, the total emission reductions are:

$$ER = FE_{baseline} + E_{baseline} - PE_{project}$$

Refer to section B.4 for details of the calculations of each source.

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**EF_{grid}**
Data unit:	tCO_2/MWh
Description:	Emission coefficient of the electricity distribution system
Source of data used:	Philippine Department of Energy (PDOE) – www.doe.gov.ph
Value/s applied:	0.490 (Luzon-Visayas grid)
Justification of the choice of data or description of measurement methods and procedures actually applied:	The combined margin emission coefficient is calculated according to AMS I.D version 12 and ACM0002 version 6, based on official data source. Please refer to Annex 3 Baseline Information and the attached spreadsheet for detailed calculation process.
Any comment:	

Data / Parameter:	**Pop**

Data unit:	Heads
Description:	Animal population the Farm
Source of data used:	Farm Specific
Value/s applied:	4702
Justification of the choice of data or description of measurement methods and procedures actually applied:	The current animal population of the farm is used for the ex-ante estimation of emission reductions. For each year during the crediting period, emission reductions will be the lower value of the two, (1) the monitored methane captured and destroyed and (2) the ex-ante estimate number.
Any comment:	

Data / Parameter:	**Capacity**
Data unit:	kW
Description:	Installed generator capacity in ACME Farm
Source of data used:	PhilBIO
Value/s applied:	100
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	**Manure management system usage**
Data unit:	%
Description:	Fraction of manure being treated by the system
Source of data used:	Project design
Value/s applied:	100
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	**Operation rate**
Data unit:	%
Description:	Fraction of time generator is operational
Source of data used:	PhilBIO’s experience
Value/s applied:	87.5
Justification of the choice of data or description of	To enhance conservativeness, the operation rate adopted is at 87.5% based on project developer’s experience.

measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	**Feed mass intake**
Data unit:	kg/day
Description:	The average mass of feed intake per head per day
Source of data used:	Philippine Department of Agriculture http://www.geocities.com/zambo_da9/tip_swine_raising.html
Value/s applied:	2.33
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	**Bo**
Data unit:	m^3 CH_4 / kg VS
Description:	Maximum methane producing capacity for manure produced by livestock category
Source of data used:	IPCC 2006 Table A10-8
Value/s applied:	0.29
Justification of the choice of data or description of measurement methods and procedures actually applied:	Default value for Asia used
Any comment:	

Data / Parameter:	**MCF**
Data unit:	%
Description:	Methane Correction Factor
Source of data used:	IPCC 2006 Table A10-8
Value/s applied:	80
Justification of the choice of data or description of measurement methods and procedures actually applied:	Default factor for Lagoon-based manure management system at 27^{o}C annual average temperature in the Philippines
Any comment:	

Data / Parameter:	**T**

Data unit:	°C
Description:	Average annual temperature
Source of data used:	Philippine Atmospheric, Geophysical & Astronomical Services Administration http://www.pagasa.dost.gov.ph/cab/climate.htm
Value/s applied:	27
Justification of the choice of data or description of measurement methods and procedures actually applied:	
Any comment:	

Data / Parameter:	**UE*GE**
Data unit:	%
Description:	Unrinary energy expressed as fraction of energy intake
Source of data used:	IPCC 2006 page 10.42
Value/s applied:	2%
Justification of the choice of data or description of measurement methods and procedures actually applied:	0.02 has been selected according to the description of equation 10.24 of the IPCC.
Any comment:	

Data / Parameter:	**DE**
Data unit:	%
Description:	Digestibility
Source of data used:	IPCC 2006 Table 10.2
Value/s applied:	80%
Justification of the choice of data or description of measurement methods and procedures actually applied:	The lower end of the feed digestibility for growing swine has been selected.

B.6.3 Ex-ante calculation of emission reductions:

AMS-I.D:
Baseline emissions are calculated as the following:
Based on the Project Developers assumptions and observations on the project's engine running time, the total annual amount of electricity from the grid displaced is estimated at 767MWh.

ACME farm will utilise a 100 kW generator engine, which is connected to the Luzon Grid[10], therefore,

Table B.6.3.a AMS-I.D Baseline

	Value	**Source**
a. Installed Capacity (kW)	100	Project
b. Genset Operating Rate	87.50%	Measured
c. Daily Electricity Generation (kWh/day)	2,100	Calculated (a x b x 24 hrs)
d. Annual Electricity Generation (MWh/year)	767	Calculated (c x 365/1000)
e. Emissions Coefficient (tonne CO2e/MWh)	0.490	Please refer to Annex 3 and the attached EF spreadsheet
Annual CO2 emission reductions from electricity generation (tonne CO2e/year)	**376**	**Calculated** **(d x e)**

Estimated annual baseline emission of the electricity displacement component of the project activities is **427 tonnes CO_2e/year.**

Project emissions:
As the Project is utilising biogas with biogenic origins to produce renewable energy, and the design of the system does not include many electrical appliance except for one blower (consuming 3.2 MWh per annum supplied by the system itself). The anthropogenic emissions from this component are considered to be zero.

Leakage:
AMS-I.D, paragraph 12, states that no leakage calculation is required since the equipment is not being transferred to or from another activity.

AMS-III.D:
Baseline emission is calculated as follows:

Country specific value for feed intake per day is:
Feed mass (kg/day) x energy per mass unit (kcal/lb) x conversion factor
Therefore,
GE (MJ/day) = 2.33 (kg/day) x 3250 (kcal/kg) x 0.0041868 (MJ/kcal) = **32 (MJ/day)**[11],

[10] Source of the emission coefficient factors of the electricity grids of the Philippines: (1) "CDM Baseline Construction for the Electricity Grids in the Philippines", prepared by the Klima Climate Change Center of the Manila Observatory for the Environmental Management Bureau of the DENR; and (2) 2005 energy date published by the Philippine Department of Energy on http://www.doe.gov.ph/power/Power%20Stat%202005%20update042406.htm

[11] Source of the daily feed intake: (1) Philippine daily feed mass, Department of Agriculture (Zamboanga Region, Philippines) http://www.goecities.com/zambo_da9/tip_swine_raising.html; (2) energy per mass unit, Herr et al. (2000), Evaluating Variable Feed Energy Levels for Grow-Finish Pigs, http://www.ansc.purdue.edu/swine/swineday/sday00/8.pdf; (3) mass unit conversion factor,

Table B.6.3.b AMS-III.D Baseline

	Value	Source
Pig population	4,702	Farm
Daily Intake per Head (MJ/day)	32	Calculated
Digestibility	80%	IPCC T10.2
Urinary Energy	0.02	IPCC page10.42
Ash Content	4%	IPCC1996 page4.23
Daily Volatile Solids Excretion (kg/day)	0.36	Calculated based on IPCC tier 2
Bo, Maximum Methane-Producing Capacity (m3/kg VS)	0.29	IPCC T10.A
MCF, Methane Conversion Factor	80%	IPCC T10.A
EF, Annual Emission Factor (kg)	20.59	Calculated
Annual Methane Capture (tonnes)	97	Calculated
Methane Density (kg/m3)	0.667	Default
Methane Content	65%	Project specific
Daily Biogas Offtake (m3/day)	612	Calculated
GWP Methane	21	Approved Global Warming Potential for CH4
Annual Baseline (tonnes CO2e/year)	**2,033**	**Calculated**

Due to the lack of evidence of animal population throughout the crediting period, the existing animal population of 2007 is used for estimation for 2008. The yearly methane generation potential of the year y during the crediting period will be calculated based on the equations above.

Project emission due to project activities is:

Table B.6.3.c AMS-III.D Project Emissions

	Value	Source
CO2 emissions from use of fossil fuel (tCO2e/year)	0	Negligible. One blower (the only electrical device of the system) requires 3.2 MWh annually, however it is supplied by the system itself.
Total project emissions (t CO2/year)	**0.0**	

Therefore, direct project emission is negligible.

Leakage:
AMS-III.D, paragraph 9, states that no leakage calculation is required.

www.onlineconversion.com; (4) feed intake rate affected by temperature, Effect of Environment on Nutrient Requirements of Domestic Animals, http://www.fermat.nap.edu/openbook.php?record_id=49638&page=32)

Total emission reductions are:

376 (AMS-I.D) + 2,033 (AMS-III.D) **-** 0 (Project Emissions) = **2,409 tonnes CO_2e/year**

B.6.4 Summary of the ex-ante estimation of emission reductions:

Due to the lack of evidence of animal population throughout the crediting period, the existing animal population of 2007 is used for estimation for 2008. The yearly methane generation potential of the year y during the crediting period will be calculated based on the equations in B.4 and B.6.3.

Table 6 Summary of ex-ante estimation of emission reductions

Year	Baseline (tCO2e)		Project Emissions (tCO2e)	Leakage (tCO2e)	ER (tCO2e)
	Methane Capture	Power			
2008	678	125	0.0	0.0	803
2009	2,033	376	0.0	0.0	2,409
2010	2,033	376	0.0	0.0	2,409
2011	2,033	376	0.0	0.0	2,409
2012	2,033	376	0.0	0.0	2,409
2013	2,033	376	0.0	0.0	2,409
2014	2,033	376	0.0	0.0	2,409
2015	1,355	376232	0.0	0.0	1,606
Total	**14,232**	**2,629**	**0.0**	**0.0**	**16,861**

B.7 Application of a monitoring methodology and description of the monitoring plan:

Metering the electricity generated and monitoring the amount of methane used as fuel or combusted as described in Appendix B of the simplified modalities and procedures for small-scale CDM project activities. The approved monitoring methodologies applied to this project are as follows:

AMS-I.D Grid Connected Renewable Electricity Generation – (13) Monitoring shall consist of metering the electricity generated by the renewable technology.

AMS-III.D Methane Recovery in Agricultural and Agro Industrial Activities – (11) The amount of methane recovered and fuelled or flared shall be monitored ex-posed, using flow meters. The fraction of methane in the biogas should be measured with a continuous analyser or, alternatively, with a periodical measurements at a 95% confidence level. Temperature and pressure of the biogas are required to determine the density of methane combusted. (12) Regular maintenance should ensure optimal operation of flares. The flare efficiency, defined as the fraction of time in which the gas is combusted in the flare, multiplied by the efficiency of the flaring process, shall be monitored; (15) Flow meters, sampling devices and gas analyzers shall be subject to regular maintenance, testing and calibration to ensure accuracy; and (17) The monitoring plan should include on site inspection for each individual farm included in the project boundary where the project activity is implemented for each verification period.

The methodology was selected as suggested by the simplified monitoring methodologies for small-scale CDM projects. Measuring the amount of methane recovered and metering the amount of electricity generated are the most appropriate methods of monitoring the project activity.

B.7.1 Data and parameters monitored:

Data / Parameter:	**Electricity**
Data unit:	kWh
Description:	Net electricity generated by the project
Source of data to be used:	Electricity meter
Value of data	
Description of measurement methods and procedures to be applied:	Electricity will be metered through the use of an electricity meter at the farm everyday. Only net electricity exported from the project activity to the user will be accounted.
QA/QC procedures to be applied:	Electricity meter will be subject to regular maintenance and testing regime to ensure accuracy once a year. The maintenance and calibration shall be conducted based on the supplier's specification and local government's calibration standards published by the Bureau of Product Standards.
Any comment:	

Data / Parameter:	**Biogas**
Data unit:	Nm3
Description:	Amount of biogas (normalised) captured and used as fuel for the generator
Source of data to be used:	Flow meter
Value of data	
Description of measurement methods and procedures to be applied:	Biogas used by the generator will be monitored through the use of biogas flow meter at each farm continuously. The flow meter automatically measures temperature and pressure, expressing biogas volumes in normalised cubic meters (Nm3), therefore no separate monitoring of temperature and pressure would be necessary.
QA/QC procedures to be applied:	Gas flow meters will be subject to regular maintenance and testing regime to ensure accuracy once a year. The maintenance and calibration shall be conducted based on the supplier's specification and local government's calibration standards published by the Bureau of Product Standards.
Any comment:	

Data / Parameter:	**Methane content**
Data unit:	%
Description:	The fraction of methane in the biogas
Source of data to be used:	Gas analyzer
Value of data	
Description of measurement methods	This will be monitored through the use of a gas analyser at the farm. In the event that the methane content of the samples varies significantly, the samples will be

and procedures to be applied:	taken on a more frequent basis. The project participant will conduct frequent methane test at the initial operational stage of the project to assure 95% confidence level of the monitoring. In the case 95% confidence level cannot be achieved during the initial stage, the project participant will adjust the monitoring frequency throughout the crediting period.
QA/QC procedures to be applied:	Gas analyser will be subject to regular maintenance and testing regime to ensure accuracy once a year. The maintenance and calibration shall be conducted based on the supplier's specification and local government's calibration standards published by the Bureau of Product Standards.
Any comment:	

Data / Parameter:	**Biogas flared**
Data unit:	Nm3
Description:	Amount of biogas (normalised) sent to the flare
Source of data to be used:	Flow meter
Value of data	
Description of measurement methods and procedures to be applied:	Biogas sent to the flare will be monitored through the use of biogas flow meter continuously. The flow meter automatically measures temperature and pressure, expressing biogas volumes in normalised cubic meters (Nm3), therefore no separate monitoring of temperature and pressure would be necessary.
QA/QC procedures to be applied:	This parameter will only be monitored when there is surplus gas from the Project and a flare is installed.
Any comment:	

Data / Parameter:	**Flare efficiency**
Data unit:	%
Description:	The fraction of methane destroyed. The flare efficiency is defined as the fraction of time in which the gas is combusted in the flare, multiplied by the efficiency of the flaring process.
Source of data to be used:	Default value from the methodology
Value of data	50% (for an open flare. If any case a closed flare is installed, the flare efficiency will be adjusted according to the Tool to determine project emissions from flaring gases containing methane.)
Description of measurement methods and procedures to be applied:	Continuous check of compliance with the manufacturers specification of the flare device (temperature, biogas flow rate) should be done. If in any specific hour any parameters is out of the range of specification 50% of default value should be used for this specific hour. For open flare 50% default value should be used, as it is not possible in this case to monitor the efficiency. If at any given time the temperature of the flare is below 500 °C, 0% default value should be used for this period.
QA/QC procedures to	Maintenance of the flare is to be conducted once a year to ensure optimal

be applied:	operation.
Any comment:	

Data / Parameter:	**Generator combustion efficiency**
Data unit:	%
Description:	The fraction of methane destroyed.
Source of data to be used:	Monitored
Value of data	
Description of measurement methods and procedures to be applied:	The generator combustion efficiency will be tested either by PhilBio's trained field manager or an external agent annually. The test will be conducted according to procedures. The test procedures will be established prior to the start of crediting period. The test result is to be recorded and used for ex-post CER calculation.
QA/QC procedures to be applied:	Maintenance of the generator set will be conducted based on supplier's requirements.
Any comment:	

Data / Parameter:	**Sludge from the CIGAR**
Data unit:	kg
Description:	It is not anticipated desludging will be take place during the crediting period based on the developer's experience. However, if in any case sludge is removed from the system, it shall be weighed and recorded.
Source of data to be used:	Farm record
Value of data	
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Farm manager's signature is required on the record.
Any comment:	

Data / Parameter:	**CIGAR cover**
Data unit:	n/a
Description:	CIGAR cover check
Source of data to be used:	Onsite monitoring record
Value of data	
Description of measurement methods and procedures to be applied:	The operation should walk over the CIGAR daily to conduct leakage inspection. Observation should be logged and submitted to the farm manager.
QA/QC procedures to be applied:	Farm manager's signature is required on the record. This will be used for cross-checking with the gas flow meter reading on the quantity of gas captured and sent to the generator.

Any comment:	

Data / Parameter:	Fossil fuel
Data unit:	kg
Description:	Amount of fossil fuel used as fuel for the generator
Source of data to be used:	Operation log
Value of data	
Description of measurement methods and procedures to be applied:	In any case fossil fuel is used in the electricity generation, the specific fuel consumption will be monitored and the electricity generation metered should be adjusted to deduct electricity generated fuelled by fossil fuel.
QA/QC procedures to be applied:	The use of fossil fuel can be cross-checked with the operation and maintenance log.
Any comment:	

During crediting period, the certified emission reduction will be claimed based on the lower one of the ex-ante estimate or the amount of methane used as fuel or combusted monitored as described above.

B.7.2 Description of the monitoring plan:

Shift Operator → Shift Manager → Farm General Manager

Project Participants monitor biogas production and electricity generation as part of standard operating procedure for the project activities. PhilBIO has developed a monitoring workbook that the farm owners must use to rigorously input and monitor these data. Project participants will keep electronic copies and paper copies for back-up purposes.

Furthermore, the operator personnel will be trained in equipment operation, data recording, reporting, and operation, maintenance, and emergency procedures. CIGAR Operators assigned on the project site will work on 8-hour shifts to record hourly power and biogas flow data and to perform engine maintenance procedures. A checklist of maintenance activities for the operators is posted in every site to ensure smooth operations.

Cluster O & M Supervisors visit each farm every week for regular performance inspections. The O&M Supervisors are responsible for reporting any system malfunction to the O&M Manager and the Chief Operating Officer. The daily data sheets are collected every week and inputted in a Monitoring Workbook by the O&M Coordinator.

The CDM Manager and the Chief Technology Officer conduct the internal audits of the GHG project compliance and operational performance respectively. The monitoring reports will be prepared by the project coordinator, reviewed by the CDM Manager prior to the verification.

A monitoring team will make regular site audits to ensure that monitoring and operational procedures are being observed in accordance with the monitoring plan and monitoring protocol.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

28/09/2007 by Dafei Huang, dafei.huang@eeafm.com and Philippine Bio-Sciences Co., Inc., west.stewart@philbio.com.ph, Tel: +632 638 2074/6092

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/11/2006 (the date when project design, engineering and procurement contract was signed)

C.1.2. Expected operational lifetime of the project activity:

21y-0m

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

01/09/2008 or the date of CDM registration, whichever is later.

C.2.1.2. Length of the first crediting period:

7y-0m

C.2.2. Fixed crediting period:

Not selected

C.2.2.1. Starting date:

N/A

C.2.2.2. Length:

N/A

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

The host country does not require an analysis of the environmental impacts of the project activities. The host country has issued each farm an Environmental Compliance Certificate (ECC).

It should be noted, however, that the project activities will generate considerable environmental benefits. The CIGAR® system decreases GHG emissions through two significant avenues. Prior to the project activity, the Projects rely on the grid for its electricity provision. With the implementation of the project activities, biogas collected from the degradation of swine-farm waste is used for electricity generation, thus eliminating the demand for grid-fed electricity. In addition to directly reducing the emission of GHGs by eliminating a source of fossil fuel combustion, the project activities will capture methane (CH_4) from an agro-industrial source, preventing its release into the atmosphere. Methane is an extremely potent GHG whose greenhouse-warming equivalent is 21 times that of carbon dioxide (CO_2).

In addition to reducing GHG emissions, this closed system of energy production will produce considerable improvements in waste management at each farm. Wastewater discharge from swine farms can be hazardous to aquatic ecosystems. The extent to which wastewater discharge threatens aquatic ecosystems depends on the amount of organic material and solid material contained within the wastewater as measured by biological oxygen demand (BOD), chemical oxygen demand (COD), suspended solids, and colour indicators. The CIGAR® system, owing to its anaerobic digestions properties, reduces COD by approximately 80%, destroys approximately 95% of harmful BOD, diminishes suspended solids, significantly reduce odour, and improves the colour quality of the wastewater. The CIGAR® system also provides a solution to odour, which is a common nuisance to the surrounding residents of these swine farms.

There are no safety regulations in the Philippines regarding the use of biogas. However, the operation safety has been taken account during the development of operation manual and its implementation. The operators see to it that the perimeter is kept free of fire hazards. The biogas generator set employed has a fail-safe mechanism, which allows for automatic shutdown in cases of low biogas flow or low methane content. Furthermore, daily checklists are provided for the operators for the proper maintenance of the generator set. The system is designed to ensure 100% containment of wastes and biogas. The system's inflatable cover is designed for gas storage. The pressure inside the digester does not build up.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Not applicable

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

PhilBIO, in cooperation with ACME Farms, Inc., conducted a CDM stakeholders' consultations for the farm's anaerobic digestion swine wastewater treatment with on-site power project for its application as a CDM project. The stakeholders' meeting was conducted last April 17, 2007 (2 – 4pm) at Consultation Tita Els Restaurant, Bagumbayan, Teresa

For the registration of Gold Standard CDM, the consultation was conducted in line with the Gold Standard requirements. Invitations were sent out to the stakeholders' concerned through phone calls and letters personally sent by the farm personnel. The consultation was also announced through the local government unit's bulletin boards, emails for the NGOs, and PhilBIO's website to give an opportunity for other stakeholders' to give their comments on the project. After the meeting, meeting report with the PDD was sent to the stakeholders for further comments.

PhilBIO's CDM Project Manager Engr. Ellen May Zanoria gave the presentations, while PhilBIO's CDM Project Manager, Engr. Angel Flores III facilitated the consultation.

The consultations were conducted in conformity with the requirement of the United Nations Framework Convention on Climate Change (UNFCCC) that clean technology projects that wish to be considered for CDM should have public or stakeholders' consultations.

Participants:

The stakeholders' consultations were well attended with a number of participants coming from the local government units (LGUs) and residents from each farm's location. These were:

- Farm representative
- Department of Agricuture's technologists
- Laguna Lake Development Authority
- Department of Environment and Natural Resources
- Municipal Heads of Government (Health, Sanitation, Engineering and Fire protection)

There were also participants from other farms who are interested to adopt an environmentally friendly technology such as the CIGAR® and know more about the CDM.

Purpose of the Meeting

The purpose of the stakeholders' consultations was to present the benefits of the anaerobic digestion swine wastewater treatment with on-site power project to the environment, swine farm owner and the community where each farm is located, and to explain what CDM is and its processes, aims and benefits. The consultations wished to stress the conformity of the projects in attaining the sustainable development goals of the country through the enhanced wastewater treatment system that will be utilized by each farm. More importantly, the consultations served as venues for stakeholders to ask questions or give comments about the projects and CDM.

The participants were informed that the proposed project was going to be registered with the Gold Standard Foundation, and that they were requested to provide their inputs through the checklist. The meeting was conducted both in English and Tagalog.

Agenda

The consultations started with an invocation led by a selected local participant. Then, a representative from the municipal government or LGU gave a brief message to welcome the participants.

The highlight of the consultations was a presentation on CDM by PhilBIO. The presentations gave an overview of the issues concerning climate change; CDM and its processes, aims and benefits; and the CIGAR project and why it is considered as a CDM project. The presentation focused on the following topics:

- Climate Change
- Clean Development Mechanism (CDM)
- The Process of CDM
- PhilBIO's Methane Gas Mitigation Technology
- The CDM Project

After each presentation, the presenter conducted an open forum where a number of questions were asked and comments were voiced out. Further details will be found in succeeding texts.

After the open forum, the facilitator thanked the participants and adjourned the meetings.

E.2. Summary of the comments received:

The stakeholders' consultation was attended by 19 people from ACME Farm, Coral Farm, Laguna lake Development Authority (LLDA), Municipal Health office, Morong Fire Station, Department of Environment and Natural Resources, Provincial Health Office, and Teresa Municipal Office.

The stakeholders focused mainly on the requirements, design, monitoring process, efficiency, capability and applicability of CIGAR.

Issue/s Raised	Response/Recommended Measures to Address the Issue/s
Does the effluent from the project system pass government standards?	Yes. However, the effluent from the CIGAR might not pass all standard parameters. The lagoons are designed to remain as a part of the wastewater treatment system. PhilBIO advises the farms to pass the effluent to the lagoon(s) prior discharge. PhilBIO also recommends the reuse of the treated wastewater from the lagoon for watering the crops and cleaning their pigpens so that discharge is minimum.

Will there be monitoring procedures for the Project?	Yes. PhilBIO described that aside from the daily monitoring sheets, it also has quarterly monitoring procedures to check each units' performance.
Most of the farms pass their discharge limits even just using lagoons, why should we use CIGAR?	First of all, the system captures the biogas that would be emitted from the anaerobic lagoon system. The gas is utilised for power generation. This displaces electricity from the grid which is mostly based on fossil fuel source. This is also a cheaper option for the farm's energy use. The technology, compared with traditional lagoon, uses less area. Odor reduction is another merit of the Project.
Will there be pathogens on the wastewater?	The system is operated at about 36-37 degrees Celsius. After the treatment process, the pathogens in the effluent are significantly reduced.
Who will finance the project? How will your company benefit?	The Project is developed by Hacienda Bio-energy Corporation and financed by Trading Emissions PLC. The foreign investment is attracted because of the sustainable development characteristics of the Project and its ability to generate carbon credits. Electricity generated by HBC will be sold to the farm at a lower price compared to the grid.
Will there be people who will take care of the daily operation of the CIGAR?	PhilBIO explained that there will be shifting operators who are trained to operate the process. For any major problems, PhilBIO's field engineers will contacted and attend to the problem immediately.

E.3. Report on how due account was taken of any comments received:

No comments opposing the projects were received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Represented by:	
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<u>Annex 2</u>

INFORMATION REGARDING PUBLIC FUNDING

Not ODA has been used in the project. No public funding has been sought.

The project developer obtained financing from Trading Emission PLC for the project development.

Annex 3

BASELINE INFORMATION

Calculation of the Baseline Emission Coefficient

As per paragraph 9 of AMS I.D version 12, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO2e/kWh) calculated in a transparent and conservative manner as:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered.
OR

(b) The weighted average emissions (in kg CO2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Option (a) is chosen. The baseline emission coefficients are calculated ex-ante as the followings:
OM: 0.644 tCO_{2e}/MWh
BM: 0.335 tCO_{2e}/MWh
CM: 0.490 tCO_{2e}/MWh

Selection of the grid

There are three grids in the Philippines, i.e. Luzon, Visayas and Mindanao[12]. The project is located at Barangay Buhangin, Rizal region of Luzon. To quote ACM0002 version 6 that 'the national or other largest grid definition should be used by default', Luzon is the largest grid of the country.

The Luzon and Visayas grids are considered as a combined grid in the calculation below, considering there is inter-connection between these two grids.[13]

OM calculation

The **Simple OM method** is used since low-cost/must run resources5 constitute less than 50% of total grid generation (Refer to Table A). Coal is not considered as a 'must run' resource. 90% of the country's coal consumption is from imported resources[14]. As the import of coal needs to be negotiated with out-of-country suppliers the amount of coal used is strictly correlated with demand and thus subject to global energy price drivers.

Table A: Gross Power Generation of Luzon-Visayas 2003-2005

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[12] *Power Sector Situationer 2007*. Department of Energy Power Statistics. http://www.doe.gov.ph/EP/Powerstat.htm
[13] The same approach has been used by a number of registered CDM projects in the Philippines, given the dispatch data is unavailable. These projects include 0454, 0590, and 0931. Among the projects using the same approach, the project activity 1951 has concluded the most conservative EF value of 0.490 tCO2/MWh.

[14] See also http://www.australiancoal.csiro.au/pdfs/grandy.pdf

Plant	2001	2002	2003	2004	2005	Average 2003-2005	5-year average %
Oil Based	9,020,314	5,276,696	5,456,423	6,588,522	3,821,517	5,288,821	71.51%
Combined Cycle	-	-	438,755	738,437	90,608	*422,600*	
Diesel	-	-	3,797,846	4,337,577	3,397,205	*3,844,209*	
Gas Turbine	-	-	41,973	82,277	25,295	*49,848*	
Oil Thermal	-	-	1,177,850	1,430,231	308,408	*972,163*	
Coal	18,650,477	16,127,887	14,938,747	16,194,412	15,257,178	15,463,446	
Natural Gas	847,580	8,770,851	13,139,410	12,384,467	16,860,917	14,128,265	
Geothermal	10,002,202	9,384,581	8,961,429	9,371,734	9,009,580	9,114,248	**28.60%**
Hydro	2,826,011	2,925,684	3,880,807	4,331,156	4,358,420	4,190,128	
Renewable	-	-	-	-	17,469	5,823	
Low cost/must run %	31%	29%	28%	28%	27%		
TOTAL	41,346,585	42,485,699	46,376,817	48,870,291	49,325,080	48,190,729	100%

The Simple OM method is used since low-cost/must run resources constitute less than 50% of total grid generation.

As fuel consumption figures are not available the fuel consumption is back calculated from the electricity generated by each technology. Please refer to below and Table B for detailed calculation. This specific approach has been published as a part of the CDM development guidance, *CDM Baseline Construction for the Electricity Grids in the Philippines,* published by the host country DNA, Klima Centre of the Metro Manila Observatory, Department of Environment and Natural Resources in 2006. Same approach of calculation has been adopted by several registered CDM projects in the Philippines, for example the San Carlos Biomass Cogeneration Project (ref. 0931).

(i) Calculating the simple operating margin.
First the CO2 emissions per technology are calculated in the following manner for each technology in steps 1 -4.

Step 1
The fuel consumption impact may be estimated by multiplying the power generation of the different electricity technologies with the corresponding heat rates for each technology, which is a measure of the heat content of the fuels used by the grid-connected power plants.

$$\mathbf{FCI_{i,y} = GEN_{i,y} * n_i} \quad (1)$$

Where,

$FCI_{i,y}$ is the fuel consumption impact expressed in Terajoules per year (TJ/yr) of grid-connected power sources for year.

$GEN_{i,y}$ is the electricity (MWh) delivered by plants using fuel *i* to the grid in the year *y*.

n_i is the heat rate (BTU/kWh) of the power plant using fuel *i*. Heat rate is the heat energy content of the fuel needed to produce one kilowatt hour (kWh) of electricity. It is a measure of a plant's energy efficiency, expressed in British Thermal Units per kWh (BTU). The heat rate used were published by official source as below.

The heat rate, n_i, of power plant on different fuels and combustion technologies are listed as below.

Type of plant	BTU/kWh[15]	MJ/kWh[16]
Coal	8,900	9.3895
Oil-based		
Combined cycle	6,550	6.91025
Diesel	*8,900*	9.3895
Gas turbine	*14,400*	15.192
Oil thermal	*8,600*	9.073
Natural Gas	6,550	6.91025

Step 2

To estimate the carbon emission impact of the grid-connected plants. The resulting fuel consumption impact (FCI) figures from Equation (1) are multiplied by the corresponding carbon emission factors (CEF) for each fuel used by the different technologies.

$$CEI_{i,y} = FCI_{i,y} * CEF_i \quad (2)$$

Where,

$CEI_{i,y}$ is the carbon emission impact of power sources *i* for the year *y* in tons of carbon per year (tC/yr).

$FCI_{i,y}$ is the average fuel consumption impact of power sources *i* for year *y* (in TJ/yr).

CEF_i is the carbon emission factor of fuel *i* which is used by power sources *i*, measured in tC/TJ. The IPCC values are used in the calculation..

[15] Page 21, *CDM Baseline Construction for the Electricity Grids in the Philippines*

[16] Conversion rate from 1 Btu = 0.0010550559 MJ (www.onlineconversion.com)

Step 3
In the process of fossil-fuel combustion, a small percentage of carbon is not oxidized and is not converted into carbon dioxide. The amount of unburned carbon is dependent on the fuel type, combustion technology, age of equipment and other such factors.

The carbon emission impact figures (CEI) derived in Equation (2) are multiplied by the corresponding fraction of carbon oxidized for each type of technology.

$$\textit{Adjusted } CEI_{i,y} = CEI_{i,y} * COM\ EFF_{i} \qquad (3)$$

Where,

$CEI_{i,y}$ is the unadjusted carbon emission impact of power sources *i* for the year *y* in tons of carbon per year (tC/yr).

$FCI_{i,y}$ is the average fuel consumption impact of power sources *i* for year *y* (in TJ/yr).

$COMEFF_{i}$ is the combustion efficiencies of power plants *a* (in %) as given in the *CDM Baseline Report* as oxidation factors (listed as below). The oxidation factors of the IPCC 2006 are 100% of the fuels used. As a conservative approach, these published factors are used in the calculation.

Combustion efficiencies[17]**:**

$COMEFF_{coal}$:	98.00%
$COMEFF_{oil}$:	99.00%
$COMEFF_{gas}$:	99.50%.

Step 4
To estimate the carbon dioxide emission impact of the grid-connected plants, the adjusted carbon emission impact figures from Equation (3) are multiplied by 44/12, which is the figure for converting carbon into carbon dioxide. It represents the molecular weight of carbon dioxide relative to that of carbon.

$$Qco2_{i,y} = \textit{Adjusted } CEI_{i,y} * 44/12 \qquad (4)$$

Where,

$Qco2_{i,y}$ is the carbon dioxide emission impact of grid-connected plants for year *y* expressed in tCO2/yr.

$FCI_{i,y}$ is the average fuel consumption impact of power sources *i* for year *y* (in TJ/yr).

$COMEFF_{i}$ is the combustion efficiencies of power plants *a* (in %) as given in the *CDM Baseline Report* as oxidation factors (listed as below). The oxidation factors of the IPCC 2006 are 100% of the fuels used. As a conservative approach, these published factors are used in the

[17] *CDM Baseline Construction for the Electricity Grids in the Philippines*

calculation.

The Simple OM emission factor, EF_{OM} (kgCO2e/kWh), is calculated as the generation-weighted average emissions per electricity unit (tCO2/MWh) of all generating sources serving the system, ***not including*** low-operating cost and must-run power plants.

$$EF_{OM} = \frac{\sum_i F_{i,y} \cdot COEF_{i,y}}{\sum_i GEN_{i,y}} \qquad (5)$$

Where,

$F_{i,y}$	is the amount of fuel *i* consumed in year y,
$COEF_{i,y}$	is the CO2 emission coefficient of fuel i (tCO2/mass or volume unit of the fuel), taking into account the carbon content of the fuels used and the percent oxidation of the fuel in year y,
$GEN_{i,y}$	is the electricity (MWh) delivered by plants using fuel *i* to the grid in the year *y*.

And, carbon dioxide emission impact of grid-connected plants using fuel *i* for year *y* can also be expressed as,

$$Qco2_{i,y} = F_{i,y} * COEF_{i,y} \qquad (6)$$

Therefore, combining equation (4), (5) and (6), EF_{OM} can be calculated as,

$$EF_{OM} = \frac{\sum_i AdjustedCEI_{i,y} * 44/12}{\sum_i GEN_{i,y}} \qquad (7)$$

Table B: Simple OM Luzon-Visayas

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
Item	**3-year average generation**	**Heat Rate**	**Fuel Consumption Impact**		**Carbon Emission Factor**	**Unadjusted Annual Carbon Emission Impact**	**Combustion Efficiency**	**Actual Carbon Emission Impact**	**Annual Carbon Dioxide Emission Impact**	**Simple OM Emission Factor**
Abbreviation	GEN		FCI		CEF	CEI	COM EFF	Adjusted CEI		EF Simple OM
Data Source	PDOE Powerstat	S1[18]	AxB	(Cx1055)/10^12	IPCC T1.3	DxE	S2[19]	FxG	Hx(44/12)	I/(A/1000)
Unit	kWh/yr	BTU/kWh	BTU/yr	TJ/yr	tC/TJ	tC/yr	%	tC/yr	tCO2/yr	tCO2/MWh
Oil Based										
Combined Cycle	422,600,000	6,550	2.76803E+12	2,920.27	20.2	58,989.49	99.00%	58,399.59	214,131.84	
Diesel	3,844,209,333	8,900	3.42135E+13	36,095.20	20.2	729,123.11	99.00%	721,831.88	2,646,716.89	
Gas Turbine	49,848,333	14,400	7.17816E+11	757.30	20.2	15,297.38	99.00%	15,144.40	55,529.48	
Oil Thermal	972,163,000	8,600	8.3606E+12	8,820.43	20.2	178,172.78	99.00%	176,391.06	646,767.21	
Coal	15,463,445,667	8,900	1.37625E+14	145,194.02	25.8	3,746,005.80	98.00%	3,671,085.68	13,460,647.49	
Natural Gas	14,128,264,667	6,550	9.25401E+13	97,629.84	15.3	1,493,736.57	99.50%	1,486,267.88	5,449,648.90	
TOTAL	**34,880,531,000**								**22,473,441.82**	**OM: 0.644**

BM calculation

The **ex-ante approach** is chosen for the BM calculation. An analysis was made based on the most recent plants built in the combined grids. The power plant capacity additions in the electricity system that comprise 20% of the generation and that have been built most recently are included in the sample group. The

[18] Source 1: page 21, *CDM Baseline Construction for the Electricity Grids in the Philippines*

[19] Source 2: page 23, *CDM Baseline Construction for the Electricity Grids in the Philippines*

build margin is calculated using the steps and equation described above. Please refer to Table C. All data used in the calculation is obtained from official source.

Table C: BM Calculation Source: PDOE, Power Planning and Development Division

	Most Recently Built Plants in Luzon and Visayas				(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)
	Plant	**Fuel**	**Date of Commission**	**Location**	**2005 Power Generation (MWh)**	**Heat Rate**	**Fuel Consumption Impact**		**Carbon Emission Factor**	**Carbon Emission Impact**	**Combustion Efficiency**	**Actual Carbon Emission Impact**	**Annual CO2 Emission Impact**	**Build Margin Emission Factor**
	Abbreviation				GEN		FCI		CEF	CEI	COM EFF	CEI		
	Source				PDOE	S1	AxB	Ax1055 /10^12	IPCC T1.3	DxE	S2	FxG	Hx(44/12)	
	Unit					BTU/kWh	BTU/yr	TJ/yr	tC/TJ	tC/yr	%	tC/yr	tCO2/yr	tCO2/MWh
1	Guimaras	Oil	2005	Guimaras, Visayas	5,917	6,550	3.876E+10	41	20.2	826	99%	818	2,998	
2	Kalayaan	Hydro	2004	Laguna, Luzon	938,923									
3	PMDP	Coal	2004	Luzon	17,888	8,900	1.592E+11	168	25.8	4,333	98%	4,247	15,571	
4	San Roque	Hydro	May-03	Benguet	605,767									
5	San Lorenzo	NG	Sep-02	Sta. Rita, Batangas	3,441,158	6,550	2.254E+13	23,779	15.3	363,823	99.5%	362,004	1,327,347	
6	Ilijan CCGT	NG	Jun-02	Batangas	6,550,741	6,550	4.291E+13	45,267	15.3	692,589	99.5%	689,126	2,526,796	
7	Cawayan	Hydro	Jun-02	Sorsogon	916									
8	Casecnan	Hydro	Apr-02	Nueva Ecija	402,584									
	Total of 5 most recent plants				**5,009,653**	<20%								
	Total of 6 most recent plants				**11,560,394**	**>20%**							**3,872,712**	**BM: 0.335**

2005 Total generation	**49,325,080**
2005 20% generation	**9,865,016**

$$EF=W_{OM}*EF_{OM}+W_{BM}*EF_{BM}=0.644*0.5+0.335*0.5=0.490tCO2/MWh$$

Annex 4

MONITORING INFORMATION

Refer to section B.7.

Annex 5

TIMELINE INFORMATION

Refer to section B.5.

Development History

	Milestone	Date	Notes and evidence
CDM consideration	PhilBIO's early CDM consideration	2004	PhilBIO, Philippine Bio-Science Inc. developed its very first Philippines pig waste water project in Rocky Farm in 1999, as the project initiator/developer and primary contractor. This particular project has been used as one of the case studies in the CDM capacity building in the Philippines.[20] The project was developed as a demonstration project to show case this alternative waste water and bio-energy resource approach in the Philippines. In the following 5 years PhilBIO developed over 20 turnkey projects with the assistance of CDM financing. All the projects have gone into the CDM registration process, among which 14 projects have been successfully registered as of April 2008.[21] The remaining projects are currently in the CDM registration queue. The services offered by the PhilBIO clearly matched the criteria for CDM.
	The establishment of Hacienda Bio-Energy Corporation for carbon finance	23/08/2006	The uptake of such CDM projects on a turnkey basis has been slow, even with the added incentive of CDM finance, as few farmers (generally relatively small family run enterprises) are willing to take risk with their own capital. The time taken to develop each project having a considerable lead time as PhiBIO educated the prospective farm owner as to the risks and benefits of a turnkey approach, as can be demonstrated by the number of projects developed since the first demonstration project at Rocky Farms. As a result Trading Emission PLC (a listed UK carbon investor) worked with PhilBIO to develop a programme to accelerate the development of these small scale projects across the Philippines, and South East Asia. In doing so, Hacienda Bio-Energy Corporation (HBC) was established to develop a programme of projects in the Philippines with

[20] A Dalusung contracted by UNDP and the Department of Environment and Natural Resources, 1999, Capacity Building in Clean Development Mechanism Project Activities: Philippines.

[21] Gold Farm (Ref 0612), Joliza Farm (0607), Uni-Rich Farm (Ref 0609), Gaya Lim Farm (Ref 0611), Paramount Farm (Ref 0605), D&C Farm (Ref 1206), Bondoc Farm (Ref 1205), Superior Farm (Ref 1208), Goldi-Lion Farm (Ref 1207), and Sunjin and Chonas bundled project (Ref 1325)

<table>
<tr><td></td><td></td><td></td><td>CDM as the motivating major driving force. All of the HBC projects are packaged as CDM projects. HBC's initial investment has financed the development of 24 waste water CDM projects in 2007, with further investments committed. This first tranche of projects is in the order of the total number of projects developed in the preceding 6 years. Project financing documents prepared by the TEP during the financing of this project will be submitted on a confidential basis to the DOE for validation review and in support of CDM registration.

Hacienda Bio-Energy was incorporated in the Philippines on 23/08/2006. Documents and certificates that demonstrate the relation of PhilBIO, HBC and TEP have been submitted and validated by the DOE.</td></tr>
<tr><td rowspan="3">Project implementation</td><td>Design and engineering contract</td><td>01/11/2006</td><td>HBC signed a design, engineering and procurement contract with PhilBIO to develop a tranche of 25 biogas projects in the pig farms with CDM implementation, ACME is one of them. Please note, finance had not yet been committed at this point by TEP and as such this was a mechanical process in preparation for the envisaged investment then being negotiated between TEP and Philbio.</td></tr>
<tr><td>Remittance received from TEP</td><td>03/01/2007</td><td>Board approval was received for the investment in December 2006, a share subscription agreement executed in that month with HBC receiving remittance from Trading Emissions PLC for projects to start implementation .</td></tr>
<tr><td>Construction started</td><td>15/01/2007</td><td>Engineering report
http://home.philbio.com.ph/index.php?option=com_content&task=view&id=78&Itemid=28</td></tr>
<tr><td rowspan="3">CDM implementation</td><td>CDM stakeholder consultation</td><td>17/04/2007</td><td>http://home.philbio.com.ph/docs/On_Going_Projects/ACME%20Meeting%20Report_290507_web%20post.pdf</td></tr>
<tr><td>Host nation approval application</td><td>14/06/2007</td><td>The submission for host nation approval was made on 14/06/07.</td></tr>
<tr><td>Validation agreement</td><td>17/10/2007</td><td>HBC signed a validation agreement with SGS on 17/10/07.</td></tr>
</table>